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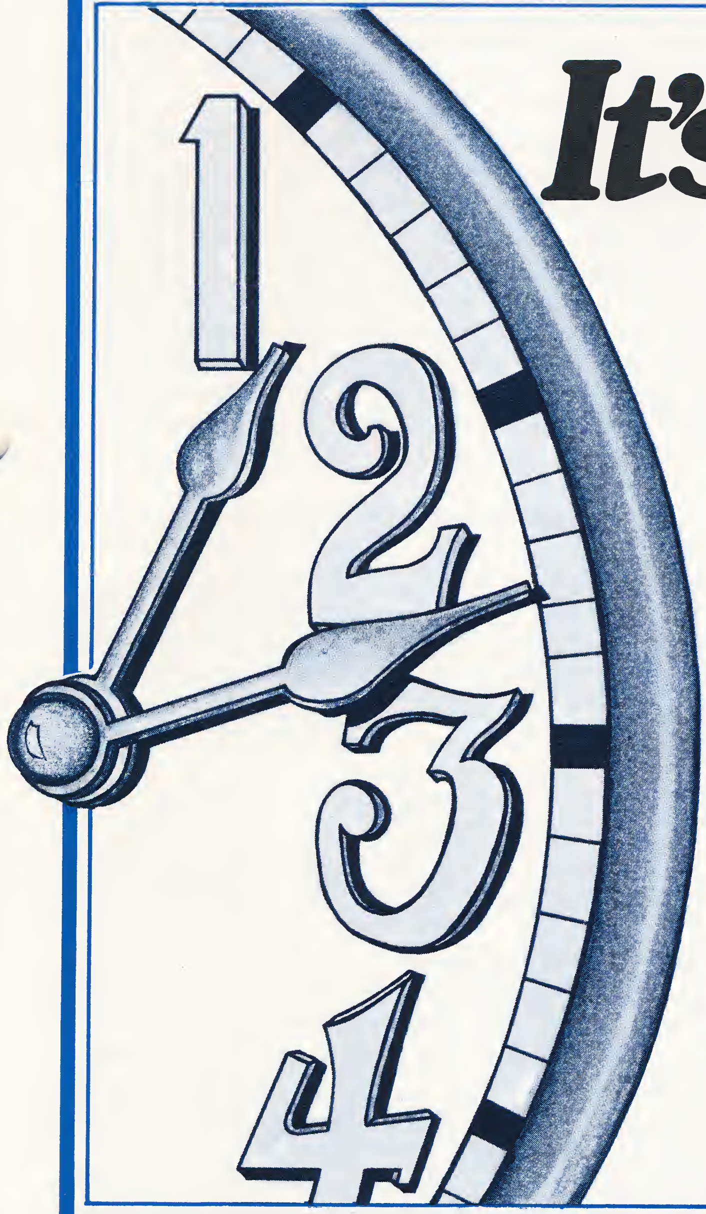
Interactive Computing

The Newsletter of the Association of Computer Users



It's about time!

It's About Time!
Editorial

With this issue, Interactive Computing proudly presents, for all members of the Association of Computer Users, a capsule summary of the results of its first half-year of small computer benchmark reports. We are now midway into our first 12-issue series of benchmark tests, and the extract which follows gives a taste of the fruits of our labors. It is actually a summary of a summary, having been distilled from a roundup report which compared the findings of the first six individual studies for subscribers of the entire series. So as we will proceed to explain, it cannot really do justice to the entire series, which contains numerous features not presented here. Nevertheless, we want to give you at least a glance at the benchmark results obtained to date.

Six-Issue Summary Compares the Systems

The mid-year summary issue of the benchmark series, from which the extract on the following pages was drawn, offers a concise summary of the hard data collected during the individual benchmark runs. Three types of tests are reported on in the individual reports: CPU intensive benchmarks, I/O intensive routines, and "real life" problems; but only the results of the "real life" problems are contained in this issue. Nonetheless, the overview provided by this comparison is at times startling. Differences in system architecture and operating system software are sharply revealed in the CPU and I/O intensive tests. The differences between systems resulted in factors of 10 and 15 commonly separating the fastest and slowest systems. (In other words, the fastest one was 10 to 15 times faster than the slowest one!) Yet all the systems tested are within about 30% of each other in fully-configured price.

Such statistics illustrate the fallacy that systems in the same price range, and in comparable configurations, necessarily provide similar performance. While some offerings excell in number-crunching, others have streamlined I/O operations or enhanced language capabilities. The benchmark tests bring out these differences, allowing us to assess the merits of each machine for a particular type of application.

Profile pages devoted to each system are a very useful feature of the full summary report. These pages list the best features and drawbacks, and the conclusions reached by the testing agency, Real Decisions Corporation. It's important to remember that the suitability for a particular application depends on many other factors in addition to speed. Software packages and vendor support play a vital role in many applications. This is particularly true when evaluating systems intended for small business users as opposed to those slated for an engineering development lab or scientific research facility. The difference in user sophistication makes the software support aspect a crucial consideration in the business application, while in many cases the scientific user does not expect to find ready-made applications programs.

User Reactions Are Important

User reactions to individual systems, also contained in the full reports on each system, help to lend a great deal of perspective to the benchmark reports. These remarks were obtained from ten or more different customers of each system, and they are a very important part of each report. By profiling the types of users attracted to each system, and getting the benefit of their experience with the product line, we begin to see the big picture surrounding the details provided by the benchmark study.

The individual reports also provide a detailed portrait of the hardware and software provided with each system. Such aspects as CPU configuration, storage facilities, peripheral devices, operating systems, available languages, utilities, package software, editors, and documentation are given full-page treatment within the reports on each system. User comments are noted for each of these parts of the total system, and summarized near the end of each report. Finally, Real Decisions Corporation outlines its own conclusions based on the benchmark results, user comments, and their

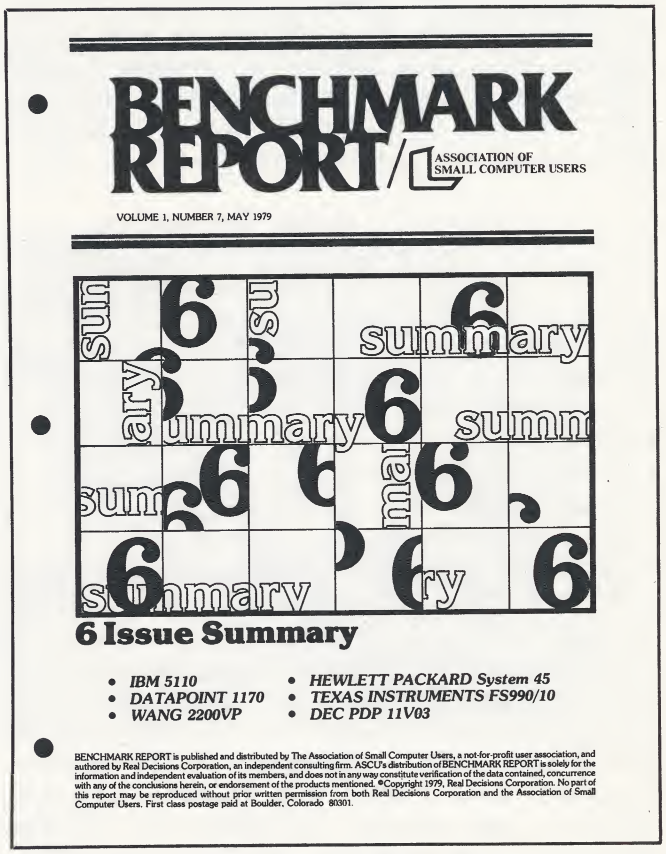
experiences in running the tests for us.

Vendors Respond Favorably

Despite the intense scrutiny to which the benchmark studies have subjected these small computers, the manufacturers involved have responded very positively. As a whole, they have complemented our efforts, and none have challenged or criticized the findings of the reports. In most cases, they've gone out of their way to be hospitable towards the lengthy benchmark process. The reactions we've received seem to indicate that our attempts to be unbiased and impartial have been fairly effective. This has been a major objective of the studies . . . to obtain the most complete view possible while appraising various systems with what is, after all, a decidedly comparative methodology.

Our plans for the immediate future include (1) completing the remaining six issues of this first benchmark series, (2) engaging another independent firm to test larger systems for us, and (3) allowing RDC to also begin testing smaller systems. Each series of reports will contain twelve issues on individual systems, two summary reports which will compare the findings, and a loose-leaf binder.

We urge all of our members to subscribe to these efforts. Those joining in the present series midway will, of course, receive all of the reports already issued, as well as the six yet to come. And should any errors of fact be discovered in a particular report, all subscribers would receive the appropriate corrections. We feel confident these benchmark reports are the most accurate, impartial analysis of a group of competitors that anyone in the industry can offer. While we're not ready yet to claim that we've started the Kentucky Derby of the computer industry, we do at least have our first set of race results. Now we can actually begin comparing horses. It's about time! hs



BENCHMARK REPORT / ASSOCIATION OF SMALL COMPUTER USERS

VOLUME 1, NUMBER 7, MAY 1979

6 Issue Summary

- *IBM 5110*
- *DATAPOINT 1170*
- *WANG 2200VP*
- *HEWLETT PACKARD System 45*
- *TEXAS INSTRUMENTS FS990/10*
- *DEC PDP 11V03*

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Twenty page summary report provided to BENCHMARK REPORT subscribers.

Benchmark Tests of Six Popular Small Computer Systems

by
The Staff Of
Real Decisions Corporation

This extract from the BENCHMARK REPORT series published by ACU contains the test results of three "Real Life Problems" which were recently run on six single-user small computers. Created and run by Real Decisions Corporation (RDC), the three benchmark programs included here are:

- C-1 — a scientific/engineering problem
- C-2 — a new product planning problem
- C-3 — an accounts receivable problem

The results for these test problems are reported for each of the following small computers:

- **IBM 5110**
- **Datapoint 1170**
- **Wang 2200VP**
- **Hewlett-Packard System 45**
- **Texas Instruments FS990/10**
- **DEC PDP-11VO3**

During the benchmarking process on each system, the RDC analyst exercised great care to obtain fair and consistent results. All benchmarks were run in BASIC with results displayed on the screen. Programs were loaded into memory and the stopwatch was readied. The RUN key and the stopwatch were pressed simultaneously; when results appeared on the screen, the stopwatch was stopped and the elapsed run time recorded.

Although the benchmark tests included in this extract reveal dramatic differences in the way each system handles a given problem, the results reported here should not be misinterpreted as the "whole story" about any of these six systems. Additional benchmarks to evaluate how a system handles CPU intensive and I/O intensive tasks have also been run for ACU's Benchmark Report series, and these results should be taken into account to round out the total comparative standing of any particular system.

In general, benchmarks are just **one** facet of judging the capabilities of a small computer. Prospective users are advised to investigate other areas of equal importance when they are evaluating a minicomputer system as a possible purchase. These other areas concern the larger framework of customer support provided by the vendor — including applications packages, maintenance services, documentation and user education.

Overview: Systems As Configured For Benchmarks

IBM 5110 — The 5110 system tested was a 32K byte Model 2 processor with a hardwired BASIC-only language, CRT and keyboard, a dual floppy drive and a 120 cps printer. Price as configured at the time of the test was $19,975; however, recent reductions announced by IBM would now set this figure at $16,435.

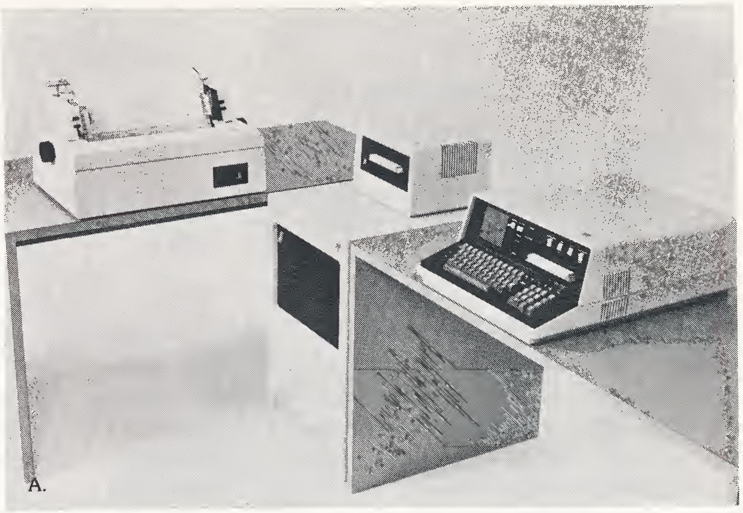
DATAPOINT 1170 — The Datapoint 1170 had a processor with 48K bytes of memory, CRT and keyboard, two diskette drives and an 80 cps printer. The BASIC language was software implemented. Price as tested was $20,330.

WANG 2200VP — The Wang 2200VP had a 32K byte processor housed in a workstation with three diskette drives. The CRT and keyboard sat on top of the workstation and a 120 cps printer completed the system. The BASIC language was hardwired, and the total price as configured was $20,700.

HEWLETT-PACKARD SYSTEM 45 — The HP System 45 was a compact desktop unit with a memory of 29,882 bytes and a hardwired BASIC language. CRT and keyboard, a built-in thermal printer and two diskette units completed the system. Price as tested was $23,650. The newly-announced System 45B decreases this price, since memory increments can now be bought for less than half the cost of previous memory options.

TEXAS INSTRUMENTS FS990/10 — TI's FS990/10 comes in a packaged configuration which includes 64K bytes of memory, two diskette drives, CRT and Keyboard, and a 150 cps printer. The BASIC language was software implemented, and the whole system's price as tested was $16,745.

SIX SMALL SYSTEMS



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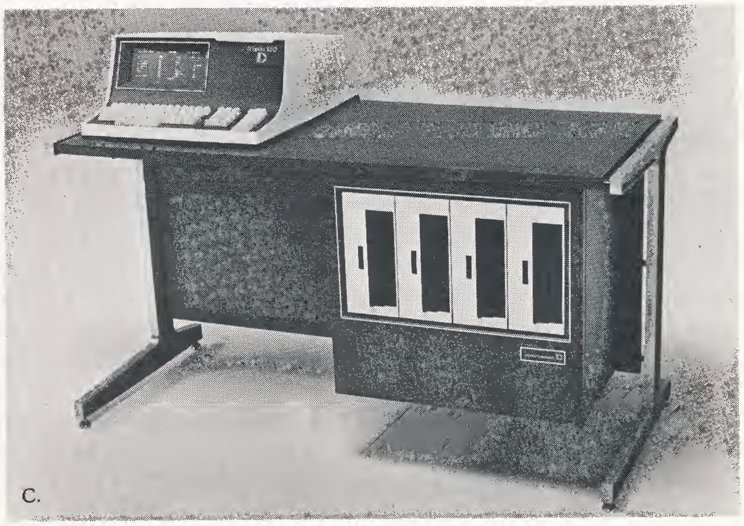

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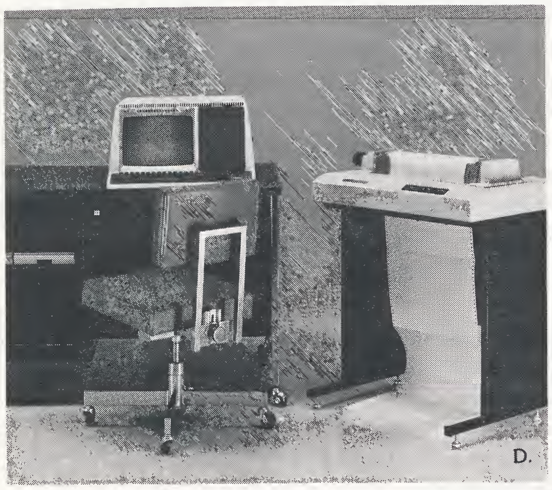
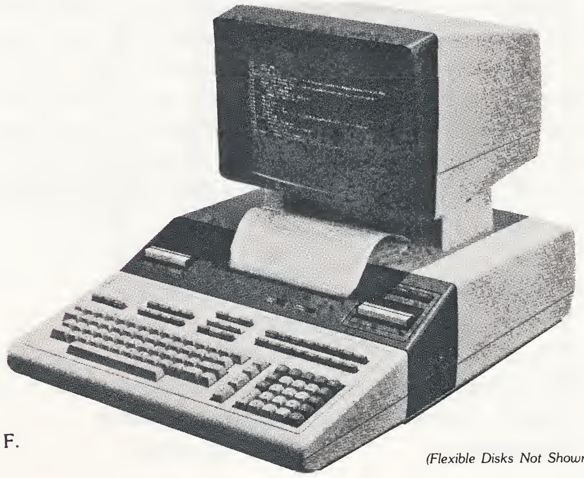


D.

A. IBM 5110
B. Texas Instruments FS990/10
C. Datapoint 1170
D. DEC PDP-11V03
E. Wang 2200VP
F. Hewlett-Packard System 45

E.



F.

(Flexible Disks Not Shown)

DEC PDP-11VO3 — Digital's PDP-11VO3 had a memory capacity of 56K bytes, CRT and keyboard, with a dual floppy drive. Although no printer was used on the machine we tested, the price of a printer was added to make this configuration comparable to the others. With printer, the total price was $14,930.

The Benchmark Problems

C-1: Scientific/Engineering Problem

This program solves a system of linear equations, using the Gauss-Jordan method of elimination. The program sets up the following system of 'N' equations with 'N' unknowns.

$$
\begin{array}{l}
0.1x_1 + 0.1x_2 + 0.1x_3 + \dots + 0.1x_N = 0.2 \\
0.1x_1 + 0.3x_2 + 0.3x_3 + \dots + 0.3x_N = 0.4 \\
0.1x_1 + 0.3x_2 + 0.5x_3 + \dots + 0.5x_N = 0.6 \\
\quad\vdots \\
0.1x_1 + 0.3x_2 + 0.5x_3 + \dots + 9.9x_N = 10.0
\end{array}
$$

To show that the run has been executed successfully, the values of x_1, x_2, and x_N are printed at the end of the execution.

C-2: New Product Planning Problem

This program models the relationship between product production costs and profitability over the range of the next four years. A base line run is established, and several parameters are varied in a "what-if" mode on subsequent runs. Program output is printed in a standard report format of report line items across column years. The model's display line items are:

-Units Sold	-Distribution
-Selling Price	-Gross Profits
-Revenue	-Fixed Costs
-Raw Materials	-Net Before Taxes
-Direct Labor	-Taxes Payable
-Packaging	-Net Income

C-3: Accounts Receivable Problem

In this job, an accounts receivable file of 50 records is created. Each record has 10 fields: customer number, salesman number, year-to-date sales, prior month sales (five fields), payments and credit limit. The file is updated randomly 10 times by customer number for sales amounts and payments. A report is displayed with billing detail, including company, salesman, year-to-date sales, credit limit, amount outstanding and sales by month.

Capsule Conclusions

IBM 5100 — On straight capabilities as tested by these benchmarks, the 5100's performance was not outstanding. However, for those users who are comfortable with the total line of IBM products and familiar with the IBM mode of operation, the 5110 is now a price-competitive system — with the "bonus" of double-density, dual-sided diskettes for maximum use of the floppy disk system.

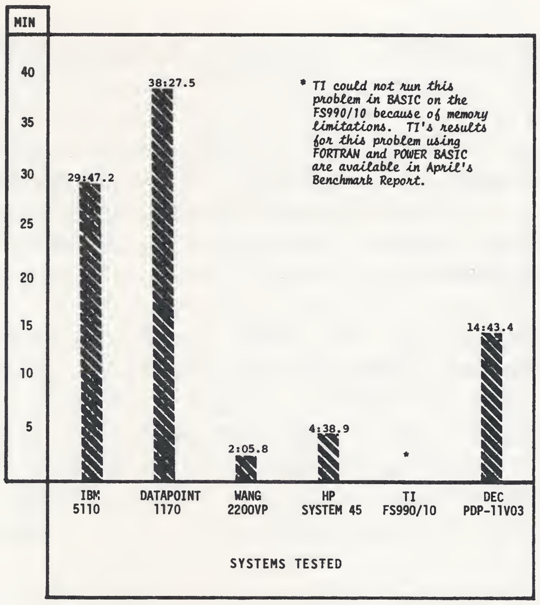
DATAPOINT 1170 — In these particular tests, the Datapoint 1170 had the highest costs for accounts receivable and scientific/engineering problems. But users who would like to start small in acquiring computer power while still keeping upgrade options open should check out the Datapoint family of products, which offers a large array of compatible hardware/software combinations.

WANG 2200VP — Clearly, Wang was an outstanding performer in these tests. The 2200VP demonstrated its powerful number-crunching capabilities by capturing two "firsts" and missing a third first place by only 1.4 seconds. Users with high requirements for I/O handling are advised to investigate this aspect of the system as reported in additional benchmark runs done for the Benchmark Report series.

(Continued — Page 11)

BENCHMARK RESULTS

C-1: SCIENTIFIC/ENGINEERING PROBLEM



BENCHMARK SUMMARY

		IBM 5110	DATAPOINT 1170	WANG 2200VP	HP SYSTEM 45	TI FS990/10	DEC PDP-11V03
		RESULTS Min:Sec	RESULTS Min:Sec	RESULTS Min:Sec	RESULTS Min:Sec	RESULTS Min:Sec	RESULTS Min:Sec
REAL LIFE PROBLEMS							
C-1	Sci./ Eng.	29:47.2	38:27.5	2:05.8	4:38.9	--*	14:43.4
C-2	New Prod.	24.2	17.3	1.2	9.3	23.2	45.8
C-3	Acc./ Rec.	4:11.0	6:50.4	3:20.0	5:05.8	3:18.6	4:14.0

*This program could not be loaded due to memory limitations.

COMMENTARY:

C-1........*In this scientific/engineering problem Wang's 2200VP was twice as fast as its nearest competitor, HP's System 45. Wang demonstrated superiority in the area of complex calculations.*

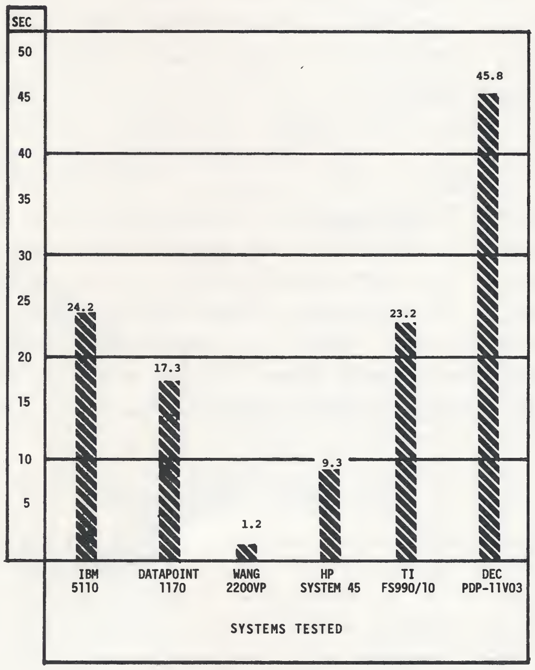
C-2........*Wang's powerful CPU capabilities again gained the 2200VP first place in this "real life" problem concerning product planning. The spread between Wang and the slowest result (DEC) is a factor of 38.*

C-3........*Results were closest in this accounts receivable problem. TI's FS990/10 beat out Wang for the top spot by only 1.4 seconds. Similarly, only three seconds separated IBM's third place result from DEC's fourth place.*

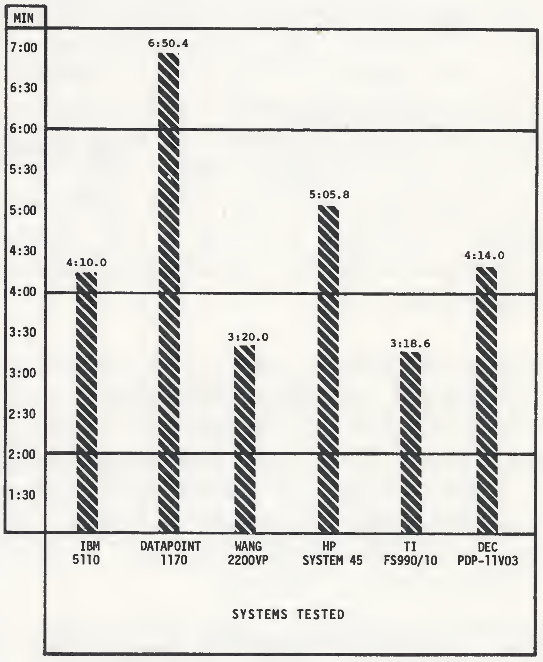
COMPARATIVE STANDINGS

	IBM	DP	WANG	HP	TI	DEC
C-1	4	5	1	2	*	3
C-2	5	3	1	2	4	6
C-3	3	6	2	5	1	4

C-2: NEW PRODUCT PROBLEM



C-3: ACCOUNTS RECEIVABLE PROBLEM



Comparing Alternative Programming Languages
APL versus FORTRAN & COBOL

By Leon P. Stevens
Standard Oil Company (Indiana)

In conventional computer programming for business applications, COBOL is probably the most commonly used computer language, while for scientific and many other purposes, FORTRAN has long been the standard. At my company, Standard Oil (Indiana), these two are by far the most widely used. But are they the best languages for **every** application? I wanted to see how COBOL and FORTRAN stood up against a *very special language, APL. Developed in the early 60's by Kenneth Iverson of IBM, APL (which stands for A Programming Language) contains, among other features, a very powerful set of instructions highly suited to numerical analysis and complex mathematical problems. Given a suitable occasion for its use, could APL save time and effort during program development? We decided to put it to the test.*

The Application

Here at Standard Oil (Indiana) the Treasurer's Department requested that a system be devised to analyze and report on the profitability of domestic and international banks. The system would extract data from existing files, manipulate it using complex logical structures, and summarize the findings in report form for output via line printer.

During the analysis stage, we found that new executive procedures would be needed to handle such a system. It was while writing those procedures that we realized this application would provide a suitable test case for the comparison of APL with our conventional COBOL/FORTRAN approach. This was due to two factors: the relatively small number of man-hours needed to develop the system, and the fact that large batch-type computer operations would not be involved in running the final product. (Since APL is an interactive language, and won't run under some batch mode operating systems, a job requiring such operations would not have been a good test of its capabilities.)

Our original estimate of the project showed that with conventional techniques, the bank reporting system would require 80 man-hours of analysis and 200 man-hours of design and implementation. The cost of these phases was placed at $2,568 and $6,420, respectively. Computer charges were estimated at $3,580, bringing the total estimated cost of the project to $12,568.

The COBOL/FORTRAN Approach

Based on an analysis of the desired system, conducted by our staff, a project plan was developed. Under the plan, the system would use an IBM time-sharing system located in Tulsa, Oklahoma, and would require two separate programs. One program, to be written in COBOL, would extract financial data from an existing data file and create a new file with the extracted data. A second program, written in FORTRAN, would then use the new file as input. The FORTRAN program would manipulate the data using arithmetic calculations and complex logical statements, producing an output file which could be printed on a Data-100 printer located in our Chicago office.

The two programs were then written and tested at our Chicago office, using our batch computer facilities which run under an MVS (Multiple Virtual Storage) operating system. When the testing was completed, the source programs were then transmitted to the Tulsa computer, recompiled, and installed on that computer's VM/CMS (Virtual Machine/Conversational Monitor System) operating system. While the two operating systems differ greatly, the exercise proved to be a textbook example of system compatibility. The Tulsa computer was able to successfully run the programs, produce an output file, and transmit the file to Chicago, where it was printed at our General Office.

The APL Approach

While development of the COBOL/FORTRAN system was in progress, I began work on a separate system which was implemented in APL. The APL version was to entirely and completely meet all the user objectives which had been defined for the system. The approach I took was similar to

that used by our other staff, although some minor details did differ.

In the APL version, the same data file was used as the starting point. A data extraction phase was designed to produce an intermediate file, which then would be input to a data manipulation and report writing phase. I designed the data extraction phase to provide as much flexibility as possible in selecting which banks would be analyzed by the report. Like the COBOL/FORTRAN version, the banks under study could be grouped by country. However, the APL version also allowed the user to specify individual banks, something the COBOL/FORTRAN version did not. Of course, this could be added to the conventional system if desired.

Another feature of the APL version was its ability to perform multiple extraction phases before entering the data manipulation and report writing phase. Again, this added to the flexibility of the system in selecting the data which was to appear in the final report schedules.

Like the COBOL/FORTRAN version, the APL system ran on the Tulsa computer under the VM/CMS operating system. The results were then transmitted to Chicago, where they were printed on the Data-100 printer.

Comparing the Systems

In the end, two very similar financial analysis systems were developed, one written in COBOL and FORTRAN, the other in APL. After they were completed and checked out, we compared the efforts and costs expended during system development, as well as the expense of operating the two systems. We found that the APL system was 69% cheaper to develop in terms of computer charges, and required 73% fewer man-hours. Here is how the development phases of the two systems compared:

System	Man-Hours	Development Cost
APL	45	$1,740
COBOL/ FORTRAN	167	$5,627

In order to compare the two systems' speed and cost of execution, we ran a series of three reports. All were done on the same facilities in Tulsa, and all were performed after 8 p.m. on the same evening. Because they were run after 8 o'clock, the user load on the computer was constant, and remained fairly low. Since the runs were done the same evening, there was no chance that any software changes could be made to the operating system between runs. Thus there were no artificial variances in the results.

We selected three sets of groupings for the runs: the first analyzed French banks only; the second, French and Canadian banks; and the third, French, Canadian, and U.S. banks. In this way, we were able to estimate the performance of the two systems when running small, medium, and large tasks. This was the result:

	Elapsed Time (Seconds)	
Report Set	FORTRAN/ COBOL	APL
France	103	140
France, Canada	121	242
France, Canada, US	190	341

As you can see, the APL system ran considerably slower than the conventional FORTRAN/COBOL solution . . . in the worst case, it took twice as long to complete the task. It's not clear exactly why this happened, but it may be that the APL version required some system resource that caused queue formation, and thus delayed completion.

We were surprised to learn, however, that although the APL system ran slower, it did not always cost more in CPU charges to execute the same task. Figuring our VM/CMS system as $2.00

per computing unit, we came up with these cost comparisons:

Report Set	Computing Cost FORTRAN/ COBOL	APL
France	$ 2.14	$ 7.12
France, Canada	8.98	11.16
France, Canada, US	19.36	15.78

These benchmark comparisons show that the APL system had a much higher setup cost than the COBOL/FORTRAN system did, but once up and running, it imposed incremental costs at half the rate of the conventional system. Thus it is likely that if a much larger task were run, the APL version would come out as the cheaper system, though in terms of real time it would probably still run slower. However, the delays in execution caused by the requirements of the APL operation (the theorized queue formation noted above) would not tend to increase the cost of execution, since no additional CPU time would be required.

Documentation Considerations

While the conventional COBOL/FORTRAN system included program documentation for use in maintaining the software, the APL system was developed with very little documentation. In the normal sense, this means the APL system, as it was written, is not maintainable. This could have been remedied by adding documentation, but given the sharply reduced development cost of APL, another solution is possible. The APL program could be considered "throwaway code."

The concept of throwaway code means that if a change in the function of the system were required, the portion of the system code affected would not be modified. Instead, that area of the code would be thrown away, and a replacement section written from scratch. While this is very expensive for conventional programming languages, with APL the cost of the throwaway code might turn out to be trivial.

Conclusions

Our comparison of development time and operating costs of using APL versus the more commonly used COBOL and FORTRAN languages brought out some interesting facts. For the development and execution of some applications, APL can provide significant savings over conventional programming languages. In the case of this study, APL required only 27% of the hours and only 31% of the total cost needed for program development.

Despite its lower development costs, our study showed that an APL program may cost considerably more to run than a comparable batch program. However, APL could be of value in such cases by providing an actual example of the system in operation. The user department could then study the results and, having access to actual system output, could more precisely state the system requirements. This more accurate system definition could then be brought to conventional system development, resulting in better utilization of information systems personnel.

Aside from the possibilities of using APL as an analysis tool, the language provides an ideal vehicle for actual implementation of small financial models, small operating reports, statistical studies, and the like. It could also be used effectively for engineering models and reports, and budget preparation and consolidation.

The IBM version of APL which we used does have some limitations. These include difficulty in processing large tape and disk files. While APL does run under the VM/CMS or MVS/VSPC (MVS/VSPC is Multiple Virtual Systems/Virtual System Personal Computing, another IBM operating system), it cannot run in batch mode under MVS. In addition, the language could be prohibitively expensive for file inquiry, when compared to CICS (IBM's Customer Information Control System).

After considering all the factors, our study showed

that, at least within my company, there is a need for APL, and that APL can indeed greatly reduce program development efforts. But can it be an effective long-term substitute for such workhorse computer languages as COBOL and FORTRAN? At this point, I have to say it is still an open question.

(Benchmark Tests — Continued from Page 6)

HEWLETT-PACKARD SYSTEM 45 — Overall, System 45 performed competently in these problems, second only to Wang in two problems and below the median in the third test. HP received general high ratings in hardware reliability and portability — a desktop and an electrical outlet are all the requirements for this compact, high-performance package to be ready to go to work.

TEXAS INSTRUMENTS FS990/10 — Because TI's interpretive BASIC takes up so much memory space, the FS990/10 could not load the C-1 problem. Results in POWER BASIC and FORTRAN — both reported in the April issue of Benchmark Report — were competitive and impressive. TI came up number one (by 1.4 seconds) in the accounts receivable problem and scored below the median in the new product planning problem. Users feel TI offers a cost-effective product through its network of OEMs.

DIGITAL EQUIPMENT CORPORATION — PDP-11VO3 — The PDP-11VO3's strongest showing was in the scientific/engineering problem, where it took third place. In the other two problems it was below the median, with the weakest area being new product planning. Users should be aware that the price quoted is without any applications software, which is added by the OEMs. Upward compatibility through the broad PDP-11 line provides extensive upgrade potential, although the VO3 itself has a memory limitation of 64K bytes.

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Zeta Research

* Previous Corporate Associate Members of ATSU are now shown as Corporate Associate Members of ACU.

**New Member.

Companies supplying computing products or services are eligible to apply for Corporate Associate Membership by writing to the Association.

Correction:

The Volume Numbers on the last two issues of "Interactive Computing" were stated incorrectly. The correct numbers are:

March/April 1979 — Volume 5, Number 2
May/June 1979 — Volume 5, Number 3

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